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That I am knowledgeable in the English language and in the language in which the below identified Japanese Patent Application was filed, and that I believe the attached English translation of the Japanese Patent Application No. **2000-353626** filed on **November 20, 2000** is a true and complete translation of the above-identified Japanese Patent Application as filed.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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SPECIFICATION

Title of the Invention

Breather System of Propulsion Unit for Small Watercraft

What is Claimed is:

1. A breather system of a propulsion unit for a small watercraft, the propulsion unit comprising: an internal combustion engine mounted in a hull as a propulsion drive source of the hull; an intake guide member extending from the internal combustion engine; an intake box externally covering an opening of an extending end of the intake guide member; a breather pipe extending from the internal combustion engine of which extending end is connected to the intake box, atmospheric air taken into the internal combustion engine through an intake passage of the intake box and an intake passage of the intake guide member in this order, blowby gas generated by the internal combustion engine taken into the intake passage of the intake box through the breather pipe, wherein

one section of the intake passage of the intake box is defined to be an oil separation chamber, the extending end of the breather pipe is opened into the oil separation chamber, and a gas discharge passage is provided for connecting the oil separation chamber to the outside and the intake passage of the intake box.

2. The breather system of a propulsion unit for a small watercraft of Claim 1, wherein a cover member is mounted for covering an inner side of the one section of the intake box, a space enclosed by the one section of the intake box and the cover member is defined to be the oil separation chamber.

3. The breather system of a propulsion unit for a small watercraft of Claims 1 or 2, wherein the extending end of the breather pipe is opened into a bottom part at a rear side of the oil separation chamber in a longitudinal direction of the hull, and an upstream end opening of the gas discharge passage is located in a forward side relative to the extending end of the breather pipe.

4. The breather system of a propulsion unit for a small watercraft of Claim 3, the propulsion unit of the watercraft including an air cleaner externally mounted on the intake box, capable of introducing the atmospheric air to the intake passage of the intake box through the intake passage inside the air cleaner, the extending end of the intake guide member extending to the intake passage inside the intake box, wherein

a downstream end opening of the gas discharge passage and the air cleaner are diverged in a horizontal direction in reference to the intake passage inside the extending end of the intake guide member.

Detailed Description of the Invention

[0001]

Field of the Invention

This invention relates to a breather system of a propulsion unit for a small watercraft in which oil is separated from blowby gas generated in an internal combustion engine.

[0002]

Background of the Invention

A conventional breather system of a propulsion unit for a small watercraft has been disclosed in Japanese Patent Laid-Open No. Hei 10-252440.

[0003]

According to the above-referenced Japanese publication, a propulsion unit of a small watercraft includes an internal combustion engine mounted by a hull as a propulsion driving source of the hull, an intake guide member extending from this internal combustion engine, an intake box externally covering an opening of an extending end of the intake guide member, and a breather pipe extending from the internal combustion engine or which extending end is connected to the intake box. Atmospheric air is guided to the inside of the internal combustion engine through an intake passage of the intake box and an intake passage of the intake guide member in this order. Blowby gas produced inside this internal combustion engine can be taken into the intake passage of the intake box through the breather pipe.

[0004]

When the internal combustion engine is driven, the atmospheric air is guided into the inside of the internal combustion engine through each of the above-mentioned intake passages to be used for combustion of fuel. The hull of the watercraft is driven forward due to driving force of the internal combustion engine as a result of the fuel combustion. Further, intake noise produced by the driving of the internal combustion engine can be dampened by the intake box.

[0005]

On the other hand, the blowby gas generated inside the internal combustion engine is taken into the intake passage inside the intake box through the breather pipe. The blowby gas is

further guided to the inside of the internal combustion engine through the intake passage of the intake guide member for combustion. Thereby, the blowby gas is prevented from being released to the outside of the propulsion unit.

[0006]

Object of the Present Invention

By the way, the above-mentioned blowby gas usually contains mist of lube oil for the internal combustion engine. When the oil mist is simply burned with the blowby gas by the internal combustion engine, consumption of the lube oil is disadvantageously increased.

[0007]

As a solution, an oil separator may be provided to separate oil from the blowby gas. However, it is not desirable for a small watercraft to add the oil separator because it increases size of the propulsion unit.

[0008]

Furthermore, the addition of the oil separator results in an increased number of parts of the propulsion unit, leading to a more complicated arrangement of the propulsion unit.

[0009]

Moreover, the oil separator is expected to effectively separate the oil from the blowby gas.

[0010]

In the above configuration, an air cleaner may be externally mounted on the intake box for preventing dusts and foreign particles from entering the air that is guided to the internal combustion engine. The atmospheric air is first filtered by the air cleaner and guided to the intake passage inside the intake box.

[0011]

However, when the blowby gas is guided to the intake box through the breather pipe, the oil mixed with the gas may be deposited onto an element of the air cleaner, whereby the filtration of the air is adversely affected.

[0012]

The present invention addresses the above-mentioned circumstances. For the propulsion unit of the small watercraft in which the blowby gas generated inside the internal combustion engine is returned to the engine through the intake passage(s), it is an object to

minimize waste of lube oil consumption for the engine and prevent an enlarged size of the propulsion unit.

[0013]

It is further an object of the present invention to avoid a complicated arrangement for the propulsion unit when the oil separator is mounted to separate the oil from the blowby gas. It is further an object of the present invention to effectively separate the oil from the blowby gas.

[0014]

In addition to the oil separator, with the air cleaner for filtering the air guided to the internal combustion engine, it is further an object to avoid oil deposits on the element of this air cleaner, whereby the good filtration of the air is maintained for a long period of time.

[0015]

Means to Solve the Problem

The breather system of a propulsion unit for a small watercraft is configured as below.

[0016]

According to the invention described in Claim 1, a propulsion unit for a small watercraft, comprising: an internal combustion engine 6 mounted in a hull 3 as a propulsion drive source of the hull 3; an intake guide member 31 extending from the internal combustion engine 6; an intake box 34 externally covering an opening 33 of an extending end 32 of the intake guide member 31; a breather pipe 61 extending from the internal combustion engine 6 of which extending end 60 is connected to the intake box 34, atmospheric air 7 taken into the internal combustion engine 6 through an intake passage 40 of the intake box 34 and an intake passage 40 of the intake guide member 31 in this order, blowby gas 57 generated by the internal combustion engine 6 taken into the intake passage 40 of the intake box 34 through the breather pipe 61.

[0017]

One section of the intake passage 40 of the intake box 34 is defined to be an oil separation chamber 59, the extending end 60 of the breather pipe 61 is opened into the oil separation chamber 59, and a gas discharge passage 63 is provided for connecting the oil separation chamber 59 to the outside and the intake passage 40 of the intake box 34.

[0018]

The invention described in Claim 2, in addition to Claim 1, is arranged that a cover member 66 is mounted for covering an inner side of one section 64 of the intake box 34, a space

enclosed by the one section 64 of the intake box 34 and the cover member is defined to be the oil separation chamber 59.

[0019]

The invention described in Claim 3, in addition to Claims 1 or 2, is arranged that the extending end 60 of the breather pipe 61 is opened into a bottom part of a rear side of the oil separation chamber 59 in a longitudinal direction of the hull 3, and an upstream end opening 72 of the gas discharge passage 63 is located in a forward side relative to the extending end 60 of the breather pipe 61.

[0020]

The invention described in Claim 4, in addition to Claim 3, is arranged that the propulsion unit of the watercraft includes an air cleaner externally mounted on the intake box, capable of introducing the atmospheric air to the intake passage of the intake box through the intake passage inside the air cleaner, the extending end of the intake guide member extending to the intake passage inside the intake box.

[0021]

A downstream end opening of the gas discharge passage and the air cleaner are diverged in a horizontal direction in reference to the intake passage inside the extending end of the intake guide member.

[0022]

Preferred Embodiment of the Invention

The preferred embodiment of the present invention is explained in the following in reference to Figures.

[0023]

In Fig. 2, a reference numeral 1 refers to a small watercraft afloat on a water surface 2. An arrow "Fr" refers to an advancing direction of the watercraft 1.

[0024]

A propulsion unit 4 for driving this hull 3 is mounted in a hull 3 of the watercraft 1. This propulsion unit 4 includes: a multi-cylinder four-stroke-cycle internal combustion engine 6 as a driving source located in an enclosed space 5 inside the hull 3, an intake system 9 located inside the space 5 by which atmospheric air 7 is guided to the internal combustion engine 6 along with

fuel 8, and an exhaust system 11 by which exhaust gas 10 discharged from the internal combustion engine 6 to the outside of the hull 3 after combustion of the fuel 8.

[0025]

In a rear side of the hull 3, a jet ejection means 14 is mounted. This jet ejection means 14 ejects water 2 rearward by means of a driving force outputted from the internal combustion engine 4. The watercraft 1 is propelled forward due to reaction force of the water ejection.

[0026]

In Figs. 1 and 3, the intake system 9 includes: a connection pipe 16 connecting atmospheric air outside the hull 3 to the space 5. Atmospheric air 7 inside the hull 3 is guided to the space 5 through the connection pipe 16, and this space 5 is considered to be the atmospheric side.

[0027]

The internal combustion engine 6 includes: a crankcase 18 supported on a bottom plate of the hull 3 and supporting a crankshaft of which center of axis extends longitudinally, and a multi (four) cylinder 19 extending from the crankcase 18 upwardly and aligned longitudinally. Each cylinder 19 includes a cylinder body 20 extending upwardly from the crankcase 18 and a cylinder head cover 21 removably fitted at an extending top end of this cylinder body 20. At the extending top end of the cylinder body 20, an intake port 22 is formed by which the cylinder body 20 is connected internally and externally. Further, a cam chamber 23 having a built-in valve gear is formed between the top end of the cylinder body 20 and the cylinder head cover 21.

[0028]

In a rear vicinity of the cylinder 19, an oil tank 27 is mounted for storing lube oil 26 for the internal combustion engine 6. This oil tank 27 is supported by the crankcase 18. The lube oil 26 stored in the oil tank 27 is supplied by an oil pump and lubricates each part inside the engine 6. The used lube oil 26 is returned to the oil tank 27 by another oil pump.

[0029]

An overflow pipe 28 for connecting the cam chamber 23 and an upper end of the oil tank 27 is also mounted. As mentioned above, while the lube oil 26 is returned to the oil tank 27, if the lube oil overflows from the oil tank 27, the flooded lube oil is guided to the cam chamber 23 through the overflow pipe 28 and temporarily stored therein. Later, the lube oil is

returned to the oil tank 27 after lubricating the valve gear and other parts.

[0030]

The intake system 9 includes: multiple (four) intake guide members 31 extending upwardly from each cylinder 19 of the internal combustion engine 6, an intake box 34 made of resin covering each opening 33 of an extending end 32 of each intake guide member in a freely opened/closed manner, and an air cleaner 35 mounted externally on this intake box 34. Each intake guide member 31 penetrates a bottom plate 36 of the intake box 34 of which extending end 32 extends upwardly from the bottom plate 36. Further, each intake guide member 31 includes a throttle valve 38 mounted in the cylinder 19 and an air horn 39 mounted in the throttle valve 38 and forming the above top end 32. The intake guide members 31 are aligned longitudinally.

[0031]

The air 7 in the space 5 inside the hull 3 passes through an intake passage 40 of the air cleaner 35, intake box 34, throttle valve 38 of the intake guide member 31 and air horn 39, in this order. The air is further taken into the cylinder 19 through the intake port 22.

[0032]

The intake box 34 includes a dish-shaped box base part 42 supported by the cylinder 19 of the engine 6 in which its lower part configures the above bottom plate 36, and a cover member 44 capable of freely opened/closed and covering the box base part 42 from its top. The cover member 44 is removably fastened by fasteners 43 to the box base part 42.

[0033]

The air cleaner 35 includes a resin cleaner case 46 forming its outer shell and an element 47 stored inside the cleaner case 46 for filtering the air 7. In this cleaner case 46, air inlets 48 are formed in which the air 7 is guided to an upstream side of the element 47 in the intake passage 40 of the air cleaner 35. Also an air outlet 49 is formed in which a downstream side of the element 47 in the intake passage 40 of the air cleaner 35 communicates with the intake passage 40 inside the intake box 34. This air outlet 49 faces horizontally with the opening 33 of the extending end 32 (air horn 39) of the intake guide member 31.

[0034]

The cleaner case 46 includes: a case base part 52 forming a lower part of the cleaner case 46 and uniformly molded with the box base part 42 and further supported by the cylinder 19

by means of a support member 51, and a cover member 53 covering the case base part 52 in a freely opened/closed manner, and uniformly molded with the cover member 44.

[0035]

A fuel injector 55 is provided to spray fuel 8 in the intake passage 40 at a downstream side of a throttle valve 38 of each intake guide member 31.

[0036]

When the internal combustion engine 6 is driven, the air 7 in the space 5 of the hull 3 is introduced to each cylinder through each intake passage 40. In this case, the air 7 is filtered by the element 47 of the air cleaner 35, whereby dust is removed and the air is purified. The fuel 8 is sprayed against this cleaned air 7 by means of the fuel injector 55 inside the intake passage 40. A drive force is generated by the fuel combustion and outputted from the internal combustion engine 6. The drive force is further transmitted to the jet ejection means 14, whereby the hull 3 is propelled forward

[0037]

A breather system 58 is arranged to return blowby gas 57 produced by the internal combustion engine 6 through the intake passage 40.

[0038]

The above breather system 58 includes: an oil separation chamber 59 as an oil separation means formed in part of the intake passage 40 inside the intake box 34, a breather pipe 61 upwardly extending from the crankcase 18 of the internal combustion engine 6 wherein its extending end 60 is connected to the bottom plate 36 of the intake box 34 and opened into the oil separation chamber 59, another breather pipe 62 extending an upper end of the oil tank 27 of which extending end is connected to a middle section of the breather pipe 61, and a gas discharge passage 63 for connecting the oil separation chamber 59 to the outside and the intake passage 40 of the intake box 34.

[0039]

More specifically, an upper surface of the bottom plate 36 of the intake box 34 extends almost horizontally while the small watercraft 1 is in a stationary position. A cover member 66 is provided for covering an inner side (top side) of one section 64 of the bottom plate 36 and being affixed to the bottom plate 36 by a rivet 65. A space enclosed by the inner side of the one section 64 and the cover member 66 is defined to be the oil separation chamber 59. The gas

discharge passage 63 forms an inner space of a manifold-shaped gas discharge pipe 67 extending from the cover member 66 of which extending end is connected to each extending end 32 of each intake guide member 31. The gas discharge passage 63 connects the oil separation chamber 59 to the intake passage 40 inside the extending end 32 of the intake guide member 31 that is the intake passage 40 inside the intake box 34.

[0040]

According to the above-described configuration, the following effects will be attained.

[0041]

Namely, when the internal combustion engine 6 is driven, a negative pressure is generated inside the intake passage 40 of the intake box 34, while the blowby gas 57 is generated inside the crankcase 8 of the engine. The blowby gas 57 is also generated inside the cam chamber 23. This blowby gas 57 is stored in an upper side of the oil tank 27 through the overflow pipe 28.

[0042]

Due to the negative pressure inside the intake passage 40 as a result of the engine operation, the blowby gas 57 respectively flows into the oil separation chamber 59 through each of the breather pipes 61 and 62. The blowby gas contains oil mist produced by the sprayed lube oil 26. When the blowby gas 57 enters the oil separation chamber 59, the flow of the blowby gas 57 temporarily slows down therein. Because the flow of the blowby gas is suddenly redirected, the oil inside the gas deposits onto an inner surface of the oil separation chamber 59. This is how the oil is separated from the blowby gas.

[0043]

Then, the blowby gas 57 is discharged from the oil separation 59 and forwarded to the intake passage 40 inside the intake box 34 through the gas discharge 63 of the gas discharge pipe 67, more specifically, to the intake passage 40 inside the extending end 32 of the intake guide member 31. Further, the blowby gas is taken into each cylinder 19 of the internal combustion engine 6 through the intake passage 40 inside each intake guide member 31 and the intake port 22, wherein the blowby gas is burned.

[0044]

In the above arrangement, the gas discharge passage 63 is connected to the intake passage 40 inside the extending end 32 of each intake guide member 31. Thus, an equal amount

of blowby gas is guided to each cylinder 19. Since inconsistent performance of the cylinders 19 is prevented, performance of the internal combustion engine 6 can be enhanced.

[0045]

On the other hand, the oil separated from the blowby gas 57 in the oil separation chamber 59 drips downward as oil droplets along the inner surface of the oil separation chamber 59. The oil further drips down to the crankcase 18 of the engine 6 through the breather pipe 61. After being recycled, they return to the oil tank 27.

[0046]

Since the lube oil 26 mixed with the blowby gas 57 is recycled without simply being returned to the engine and burned therein, the lube oil 26 will not be wasted.

[0047]

As mentioned above, the oil separation chamber 59 for separating the oil from the blowby gas is defined by one section of the intake passage 40 inside the intake box 34. Such arrangement can prevent wasted consumption of the lube oil 26, and the size of the propulsion unit 4 will not be enlarged.

[0048]

Furthermore, as mentioned above, the cover member 66 is provided for covering the inner side of one section 64 of the intake box 34. The oil separation chamber 59 is defined by the space enclosed by the cover member 66 and one section 64 of the intake box 34.

[0049]

With one section 64 of the intake box 34, the oil separation chamber 59 is defined, whereby the oil is separated from the blowby gas. This simple configuration of the oil separation chamber 59 can prevent a complicated configuration of the propulsion unit 4.

[0050]

Moreover, according to the above configuration, the extending end 60 of the breather pipe 61 is opened in the bottom part of a rear side of the oil separation chamber 59 in the longitudinal direction of the hull 3. An upstream end opening 72 of the gas discharge passage 63 to the oil separation chamber 59 is located in a forward side relative to the extending end 60 of the breather pipe 61.

[0051]

When the small watercraft is propelled forward, a front section of the hull 3 is elevated

due to reaction force of the water 2; as a result, the hull 3 tend to keep an uphill posture.

[0052]

As the hull 3 takes the uphill posture, the bottom part at the rear side of the oil separation chamber 59 takes a downhill posture. Thus, the lube oil 26 collected at the bottom part of the oil separation chamber 59 flows rearward and downhill.

[0053]

Since the extending end 60 of the breather pipe 61 is opened in the bottom part at the rear side of the oil separation chamber 59, the lube oil 26 flowing rearward along the bottom part of the oil separation chamber 59 is discharged smoothly and returned to the crankcase 18 of the internal combustion engine 6.

[0054]

On the other hand, with the uphill posture of the hull 3, the oil separation chamber 59 takes the uphill posture as well. As mentioned above, the upstream end opening 72 of the gas discharge passage for the oil separation chamber 59 is located in the forward side relative to the extending end 60 of the breather pipe 61. Thus, after the oil separation, the blowby gas 57 smoothly passes through the gas discharge passage 63 without being interfered with the lube oil 26 that flows rearward at the bottom side of the oil separation chamber 59. Thereby, the blowby gas 57 will not be mixed with the oil again.

[0055]

Since the oil is more effectively separated from the blowby gas in the oil separation chamber 59, the lube oil 26 will not be wasted.

[0056]

Furthermore, in the above arranged propulsion unit of the watercraft, the air cleaner 35 is externally mounted on the intake box 34, capable of introducing the atmospheric air 7 to the intake passage 40 of the intake box 34 through the intake passage 40 inside the air cleaner 35, and the extending end 32 of the intake guide member 31 extending to the intake passage 40 inside the intake box 34.

[0057]

A downstream end opening 73 of the gas discharge passage 63 and the air cleaner 35 are diverged in a horizontal direction in reference to the intake passage 40 inside the extending end 32 of the intake guide member 31.

[0058]

The blowby gas 57 discharged from the downstream end opening 73 of the gas discharge passage 63 is guided to the intake passage 40 inside the extending end 32 of the intake guide member 31 before directing to the air cleaner 35, whereby the blowby gas 57 is blocked from going to the air cleaner 35.

[0059]

Since the oil remained in the blowby gas 57 will not deposit on the element 47 of the air cleaner 35, an air filtration effect of the air cleaner 35 can be maintained for a long time, allowing better engine performance.

[0060]

The above arrangement is illustrated in the drawings. Another modification is also acceptable in which the downstream end opening 73 of the gas discharge passage 63 is opened in the intake passage 40 of the intake box 34, except the intake passage 40 of the intake guide member 31. In this case, it is also acceptable to eliminate the downstream end opening 73 and the gas discharge passage 63, wherein the upstream end opening 72 functions as both upstream/downstream end openings. In addition, the one section 64 of the intake box 34 may be a vertical wall of the intake box 34.

[0061]

Effects of the Invention

The effects of the present invention are described in the following.

[0062]

According to the invention described in Claim 1, a propulsion unit for a small watercraft is comprising of: an internal combustion engine mounted in a hull as a propulsion drive source of the hull; an intake guide member extending from the internal combustion engine; an intake box externally covering an opening of an extending end of the intake guide member; a breather pipe extending from the internal combustion engine of which extending end is connected to the intake box, atmospheric air taken into the internal combustion engine through an intake passage of the intake box and an intake passage of the intake guide member, blowby gas generated by the internal combustion engine taken into the intake passage of the intake box through the breather pipe.

[0063]

One section of the intake passage of the intake box is defined to be an oil separation chamber, the extending end of the breather pipe is opened into the oil separation chamber. Conversely, a gas discharge passage is provided for connecting the oil separation chamber to the outside and the intake passage of the intake box.

[0064]

Namely, when the internal combustion engine is driven, negative pressure is produced in the intake passage of the intake box. On the other hand, the blowby gas is generated inside the internal combustion engine.

[0065]

Due to the negative pressure inside the intake passage as a result of the engine driving, the blowby gas flows into the oil separation chamber through the breather pipes. The blowby gas contains oil mist produced by the sprayed lube oil. When the blowby gas enters the oil separation chamber, the oil is separated from the blowby gas inside this oil separation chamber. Then, the blowby gas is discharged from the oil separation chamber and guided to the intake passage inside the intake box through the gas discharge passage. Later, the blowby gas is returned to the internal combustion engine and burned therein.

[0066]

Since the lube oil mixed with the blowby gas that is generated in the internal combustion engine is recycled without simply being returned to the engine and burned therein, the lube oil will not be wasted.

[0067]

As mentioned above, the oil separation chamber for separating the oil from the blowby gas is defined by one section of the intake passage inside the intake box. Since the lube oil is not wasted, the size of the propulsion unit will not be enlarged.

[0068]

The invention described in Claim 2 is arranged that the cover member is mounted for covering an inner side of one section of the intake box, and the space enclosed by the one section of the intake box and the cover member is defined as the oil separation chamber.

[0069]

With one section of the intake box, the oil separation chamber is defined, whereby the oil is separated from the blowby gas. This simple configuration of the oil separation chamber

can prevent a complicated configuration of the propulsion unit.

[0070]

The invention described in Claim 3 is arranged that the extending end of the breather pipe is opened into the bottom part at the rear side of the oil separation chamber in the longitudinal direction of the hull, and the upstream end opening of the gas discharge passage is located in the forward side relative to the extending end of the breather pipe.

[0071]

When the small watercraft is propelled forward, the front section of the hull is elevated due to reaction force of the water; as a result, the hull tends to keep an uphill posture.

[0072]

As the hull takes the uphill posture, the bottom part at the rear side of the oil separation chamber takes a downhill posture. Thus, the lube oil collected at the bottom part of the oil separation chamber flows rearward and downhill.

[0073]

Since the extending end of the breather pipe is opened in the bottom part at the rear side of the oil separation chamber, the lube oil flowing rearward along the bottom part of the oil separation chamber is discharged smoothly and returned to the crankcase of the internal combustion engine.

[0074]

On the other hand, with the uphill posture of the hull, the oil separation chamber takes the uphill posture as well. As mentioned above, the upstream end opening of the gas discharge passage for the oil separation chamber is located in the forward side relative to the extending end of the breather pipe. Thus, after the oil separation, the blowby gas smoothly passes through the gas discharge passage without being interfered with the lube oil that flows rearward at the bottom side of the oil separation chamber. Thereby, the blowby gas will not be mixed with the oil again.

[0075]

Since the oil is more effectively separated from the blowby gas in the oil separation chamber, the lube oil will not be wasted.

[0076]

In the propulsion unit of the watercraft described in Claim 4, the air cleaner is externally

mounted on the intake box, capable of introducing the atmospheric air to the intake passage of the intake box through the intake passage inside the air cleaner, and the extending end of the intake guide member extending to the intake passage inside the intake box.

[0077]

The downstream end opening of the gas discharge passage and the air cleaner are diverged in the horizontal direction in reference to the intake passage inside the extending end of the intake guide member.

[0078]

The blowby gas discharged from the downstream end opening of the gas discharge passage is guided to the intake passage inside the extending end of the intake guide member before directing to the air cleaner, whereby the blowby gas is blocked from going to the air cleaner.

[0079]

Since the oil remained in the blowby gas will not deposit on the element of the air cleaner, an air filtration effect of the air cleaner can be maintained for a long time, allowing better engine performance.

Brief Description of Drawings

Fig. 1 is a cross-sectional view taken along the line 1-1 shown in Fig. 2.

Fig. 2 is a side view of the small watercraft.

Fig. 3 is a perspective view of the propulsion unit.

Fig. 4 is a top plan view of the propulsion unit, part of which is broken.

Description of Reference Numerals

1: Small Watercraft	2:Water
3: Hull	4: Propulsion Unit
6: Internal Combustion Engine	7: Atmospheric Air
8: Fuel	9: Intake System
26: Lube Oil	31: Intake Guide Member
32: Extending End	33: Opening
34: Intake Box	35: Air Cleaner
36: Bottom Plate	40: Intake Passage
47: Element	57: Blowby Gas

58: Breather System
59: Oil Separation Chamber
60: Extending End
61: Breather Pipe
62: Breather Pipe
63: Gas Discharge Passage
64: One Section
66: Cover Member
72: Upstream End Opening
73: Downstream End Opening

ABSTRACT

Object

For a propulsion unit of a small watercraft in which blowby gas generated in an internal combustion engine is returned to the internal combustion engine through (an) intake passage(s) and burned therein, it is designed to minimize waste of lube oil consumption of the internal combustion engine and prevent an enlarged propulsion unit.

Means for Solution

The atmospheric air 7 is guided to the internal combustion engine 6 through the intake passage 40 inside the intake box 34 and intake passage 40 of the intake guide member 31 in this order, the blowby gas 57 generated inside the internal combustion engine 6 is taken into the intake passage 40 of the intake box 34 through the breather pipe 61. The oil separation chamber 59 is defined by one section of the intake passage 40 of the intake box 34. The extending end 60 of the breather pipe 61 is opened into this oil separation chamber 59, and the gas discharge passage 63 is provided to connect the oil separation chamber 59 to the outside and the intake passage 40 of the intake box 34.

Selected Drawing

Fig. 1

CONFIRMED AND ADDED INFORMATION

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